
Prehospital Pediatric Care

Respiratory Emergencies

Provider Manual

Prehospital Pediatric Care Provider Manual

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Table of Contents

Basic Course Directions	4
Introduction	5
 Anatomical Features of the Pediatric Airway -Part A	 6
Desired Outcomes	12
Quiz	14
Video Section.....	11
 Prehospital Assessment -Part B	 8
Desired Outcomes	13
Quiz	14
Video Section.....	11
 Common Upper Airway Emergencies -Part C	 17
Desired Outcomes	20
Quiz.....	21
Video Section.....	19
 Common Lower Airway Emergencies -Part D	 23
Desired Outcomes.....	26
Quiz.....	28
Video Section.....	25
 Respiratory Failure -Part E	 30
Desired Outcomes.....	31
Quiz.....	32
Video Section.....	30
 Prehospital Management -Part F	 33
Desired Outcomes.....	35
Quiz.....	36
Video Section.....	34
 Technology Assisted Children (TAC) -Part G	 38
Desired Outcomes.....	39
Video Section.....	38
 Appendix Video Section	

Basic Course Directions

Read the **Desired Outcomes** for each part. These will give you clues to the knowledge you should gain by completing this course.

View the part of the **Videotape** which corresponds to your workbook section. Place the videotape in your VCR and reset the video counter to "0000". The counter numbers shown are approximate (your VCR must be in "SP" or standard, 2-hour play mode).

Between sections of the program you may either pause or stop the videotape. Caution: Be aware that long pause times can damage the tape.

Take notes of concepts you want to reinforce and complete the blank segments of the Desired Outcomes as you watch the videotape. Jot down any notes or questions in the sidebars of your workbook. **Discuss** topics or questions with your instructor.

Complete the **Quiz Questions**.

Evaluate your comprehension of the section. Try to fill in the Desired Outcomes again from memory. Review or continue as desired.

Introduction

Understanding the dynamics of pediatric respiratory problems and skill proficiency in airway management are top priorities for all prehospital providers.

Airway has always been top priority in emergency care, but it is even more critical in pediatric emergencies. Difficulty breathing is the most common pediatric dispatch for EMS personnel. Sometimes it is a minor problem; other times, life threatening.

It seems impossible that in today's sophisticated environment of technology, communication and experience, children's outcomes can actually be impaired due to mismanagement of the airway and respiratory system--but statistics say different.

Statistics point to the fact that for some reason, providers of care are missing vital clues about respiratory distress or failure and are not initiating care in a timely manner. Result!! Children who should survive are dying!

PERHAPS it is because the pediatric respiratory system is complex and the signs and symptoms of problems not always as apparent as with adults? PERHAPS it is because we have not had equipment sized to fit children? PERHAPS it is because we have neglected learning about children and have tried to manage them as adults?

It is most likely a combination of errors, but it is time for the statistics to change and for the children to survive and live to play and grow and learn.

The challenge to you, to ALL of those responsible for providing care to ill and injured children is that you study and practice and never allow ignorance or apathy to impair the care you give.

THE KIDS ARE COUNTING ON YOU!

Anatomical Features of the Pediatric Airway – Part A

Children, especially infants and young children, are more susceptible than adults to respiratory illnesses because of specific developmental factors. Consider the following:

1. The anatomical development of the respiratory tract makes it prone to foreign body obstruction, prone to obstruction from swelling caused by infections and more difficult to treat or manage.
2. The immature nature of the pediatric immune system allows children to have less resistance to bacteria and virus.
3. Growth and development characteristics promote excessive amounts of objects or substances being placed into the mouth. These same characteristics mean less ability to chew or swallow or recognize danger and this places the respiratory system at risk for obstruction and contamination.

Children have the same respiratory physiology as adults. Lets review:

1. OXYGENATION occurs when O₂ molecules enter the lungs during inhalation and then move through the alveoli into the blood stream. They attach to red blood cells, are transported to body tissues/organs and then metabolized for body growth and repair. During normal metabolism, the waste product, carbon dioxide, is formed. It is transported by the blood, back to the lungs and released from the body during exhalation. Carbon dioxide is an acid; excessive amounts of carbon dioxide in the blood create the condition of acidosis.
2. VENTILATION refers to the physical actions of inhalation and exhalation. Without ventilation, oxygenation doesn't happen! In addition, waste products of metabolism accumulate in cells and tissues and alter the acid/base balance of the body. Prolonged alterations in acid/base balance are not compatible with life. The muscular movements of inhalation and exhalation must occur at a RATE that ensures an adequate supply of oxygen, and with enough force or DEPTH that gas exchange occurs. A common prehospital mistake is the application of oxygen without recognition of inadequate ventilation. Children with respiratory distress often fatigue and don't have the energy to sustain adequate ventilation. Do not hesitate to support ventilation when indicated.

3. There are several unique anatomical features of the pediatric airway that increase susceptibility to airway disease and problems. Details are included in the video but they include:
 - a. TONGUE -relatively large in proportion to oral cavity
 - b. OBLIGATE NOSE BREATHING -evident in infants less than 2 months old
 - c. LARYNX -relatively anterior and high (C2 in neonate; C3-4 in child; C5-6 in adults)
 - d. TRACHEA -smaller and shorter than that of adults (newborn -5 cm in length, 18 months old -7 cm)
 - e. CHEST WALL -relatively weak and unstable in infants

Prehospital Assessment – Part B

The general principles of pediatric assessment which were presented in Module One are most appropriate when you consider the assessment of a child with a respiratory problem.

HISTORY

Follow the general outline presented in Module One/ Pediatric Basics. In addition, there are some specific history questions which will assist in determining the general location of the illness and also guide in field management.

1. Inquire about FEVER ?
 - a. The acute onset of respiratory distress in the absence of fever suggests foreign body aspiration
 - b. Lower airway diseases (except asthma), croup and epiglottitis all have associated fever. Croup often has a history of low-grade fever for several days. (100-101 degrees F) Temperature elevation with epiglottitis is acute, (within < 12 hours of onset of respiratory distress) and often above 104 degrees F
2. Ask about any acute coughing or choking episodes?
 - a. Most suggestive of foreign body aspiration
 - b. Croup often has periods of coughing
3. Investigate the child's ability to drink, talk or drool?
 - a. Difficulty swallowing suggests upper airway problems
 - b. Fever and drooling suggest epiglottitis
4. Question if the child's voice has changed?
 - a. A hoarse voice suggests croup
 - b. Muffled sounds or refusal to talk suggests epiglottitis
5. Inquire about similar problems in the past?
 - a. If so, what was the outcome?
 - b. Premature infants may have chronic lung disease
6. Ask if the child is a known asthmatic?
 - a. Medications and last dose
 - c. Comparison of this attack to others in past

PRIMARY SURVEY

The primary survey also follows the general guidelines presented in Module One, Pediatric Basics. Remember: **always look before touching** and limit your examination to the essentials. Fear, agitation and crying tend to make respiratory distress worse and greatly impairs the assessment process.

Signs which indicate problems with the airway or breathing include:

1. Stridor -crowing sound of upper airway obstruction
2. Abnormal respiratory rate
 - a. Observe the respiratory rate by watching the rise and fall of both chest and abdomen. Have a parent expose the child's chest if possible.
 - b. A rate above 60 is abnormal in any age child
 - c. **ABNORMALLY SLOW RATES ARE MORE WORRISOME THAN TACHYPNEA AND SIGNAL RESPIRATORY FAILURE**

Newborn	30-60
6 Months	25-40
1-3 Years	20-30
6 Years	18-25
10 Years	15-20

3. Retractions
 - a. Indicate increased work of breathing
 - b. May be subcostal, intercostal or supraclavicular
4. Nasal Flaring -An attempt to overcome airway resistance and enhance airflow into the respiratory tree
5. Grunting- An expiratory noise made to generate pressure at the end of expiration which acts to keep the alveoli open and promote gas exchange
6. Positioning
 - a. Tripod: child seated, leaning forward and supported on outstretched arms; opens chest cavity and maximizes use of accessory muscles
 - b. Sniff: head positioned with jaw thrust forward in an effort to open the airway; characteristic of upper airway problems such as epiglottitis

7. Color
 - a. Pallor, gray coloring
 - b. Cyanosis -reflects a critical level of deoxygenated blood and is a LATE, unreliable sign of hypoxemia)
8. Heart Rate
 - a. Tachycardia is commonly seen with respiratory problems
 - b. BRADYCARDIA -Once again it is emphasized that bradycardia in a child with respiratory distress, signals imminent cardiopulmonary arrest
9. Altered Mental Status
 - a. Changes are critical to assess
 - b. Agitation and irritability may indicate hypoxemia
 - c. Lethargy and decreased responsiveness may denote severe hypoxemia or hypercarbia

If any of the above signs are observed during the primary survey, intervention to correct inadequate oxygenation and/or ventilation should immediately be undertaken. The need for expeditious transport should also be considered.

SECONDARY SURVEY

The physical exam should be limited to essentials, but should include auscultation of lung sounds if possible. Field noise and/or crying may make this impossible. Abnormal breath sounds which may help localize the site of problems include:

1. Snoring -due to upper airway obstruction, especially the tongue, falling and occluding the posterior pharynx
2. Stridor- crowing, high-pitched sound heard on inspiration; indicative of turbulent airflow through the larynx and obstruction in larynx
3. Wheezing -hissing, musical expiratory sound indicative of medium sized airway obstruction as occurs with asthma or bronchitis
4. Crackles -soft, inspiratory noises caused by fluid/secretions in the alveoli as occurs with pneumonia or bronchitis

To review:

Agitation and/or crying tends to make respiratory distress worse and make your assessment of the respiratory system difficult.

Young children are often frightened of strangers such as you; they dislike being examined and your approach and touching may agitate and precipitate crying.

ALWAYS LOOK BEFORE TOUCHING!

It is imperative that you are knowledgeable of the signs and symptoms of respiratory distress and that you analyze and consider the possibility of this grave problem regardless of chief complaint to which you have responded. Remember, respiratory distress may result from abnormalities anywhere in the tracheobronchial tree, lungs, pleura or chest wall.

Techniques for assessment of the pediatric respiratory system are outlined in the videotape. Remember to take notes and complete the desired outcomes. You can do this as you view the video or after completion of individual parts. If the information is new, you will probably need to see the videotape more than once to learn the concepts.

VIEW VIDEOTAPE PART A&B

DESIRED OUTCOMES

The completion of Part A should enable you to:

1. Describe the physiology of oxygenation:

2. Explain the relationship between oxygenation and ventilation:

3. List the five unique anatomical features of the pediatric respiratory system and describe the problems created by each:

- a.

- b.

- c.

- d.

4. Describe actions for each of the five anatomical features which will either alleviate or help overcome the problems of airway management:

- a.

- b.

- c.

- d.

- e.

DESIRED OUTCOMES

The Completion of Part B should enable you to:

1. List and describe six history questions which are specific to problems of the respiratory system:
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
 - f. _____
2. List and describe at least six physical signs which are indicative of airway or breathing problems:
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
 - f. _____
3. Of the above signs, which one is most indicative of imminent cardio-pulmonary arrest?

4. Describe three observations initially made regarding the status of the respiratory system:
 - a. _____
 - b. _____
 - c. _____
5. Outline the best technique for counting respirations which hopefully may deter the child from crying:

6. Compare the abnormal sound of wheezing to that of crackles:

7. Describe the significance of the sounds of snoring and stridor:
 - a. snoring _____
 - b. stridor _____

QUIZ

1. The process by which molecules of oxygen are carried via the blood stream to body tissues for use in metabolism is called?
 - a. inhalation
 - b. ventilation
 - c. oxygenation
 - d. exhalation
2. Which of the following is necessary to ensure oxygenation and acid/base balance?
 - a. adequate rate and depth of inhalation
 - b. adequate supplies of available oxygen
 - c. appropriate rate and depth of exhalation
 - d. depth and rate of inhalation and exhalation
3. You are called to the scene of a fight where a 7 year old has been hit in the chest with a bat. He is unconscious and has the following vital signs. BP 134/86 P 88 and irregular RR 6. On assessment he has one pupil which is dilated and a bruise at nipple line on the anterior chest. What should you do first to care for this pt.?
 - a. insert an airway and apply oxygen per face mask at 100%
 - b. insert an airway and begin assisted ventilation with high flow O₂
 - c. insert an airway, apply oxygen at 6 liters and attempt to find a family member to give you a health history
 - d. apply oxygen, attempt to start an IV, and transport as soon as the IV is in place; apply cardiac monitor if available
4. Which of the following would NOT contribute to the obstruction of the airway by the tongue?
 - a. dehydration
 - b. fatigue
 - c. unconsciousness
 - d. infection
5. Which of the following statements is CORRECT regarding pediatric anatomy?
 - a. the position of the larynx will promote airway obstruction if the head is hyperextended
 - b. the construction of the trachea enhances intubation but promotes extubation
 - c. the smallest diameter of the trachea is the glottic opening
 - d. the larynx is very posterior and promotes foreign body obstructions

6. Which of the following statements is NOT correct regarding pediatric respiration?
 - a. respiration is dependent on the work of the diaphragm
 - b. during normal breathing, the abdomen rises and falls opposite chest movement
 - c. prolonged tachypnea or dyspnea can cause respiratory failure
 - d. the chest wall is thin, weak and unstable

7. Foreign bodies and edema more easily obstruct the pediatric airway because of which of the following?
 - a. the position of the larynx
 - b. the position of the trachea
 - c. the small diameter of the airway tubes
 - d. the soft, collapsible nature of the components of the airway

8. Which of the following history questions would NOT be helpful in determining the etiology of a respiratory problem?
 - a. the presence and onset of fever
 - b. changes in the child's willingness to talk or swallow
 - c. alterations in the child's awareness of parents or siblings
 - e. changes in the child's voice

9. Which of the following signs observed during the primary survey is indicative of partial obstruction of the upper airway?
 - a. stridor
 - b. nasal flaring
 - f. sniff position
 - d. cyanosis

Match the signs (a-e) to the appropriate description (10- 13).

10. sign of deoxygenated hemoglobin _____
 11. reflex to promote airflow _____
 12. reflects increased work of breathing _____
 13. sign of respiratory arrest _____
 - a. nasal flaring
 - b. grunting
 - c. cyanosis
 - d. retractions
 - e. bradypnea
-
14. An abnormal lung sound heard during exhalation which is caused by obstruction of bronchial tubes by swelling or spasm is called?
 - a. stridor
 - b. wheezing
 - c. crackles
 - d. snoring

Common Upper Airway Emergencies – Part C

Croup, epiglottitis and foreign body obstruction are the three upper airway emergencies common to prehospital providers. The workbook has a brief synopsis and comparison of each and outlines therapies. The video emphasizes the typical history and signs and symptoms.

CROUP

Croup is a viral infection which causes edema of the larynx, vocal cords and subglottic tissues. The swelling (edema) results in partial upper airway obstruction. Cold symptoms usually precede the onset of croup symptoms,

Croup is a common occurrence, especially in the winter and most often occurs in children ages 6 months to 3 years. It is not usually an acute problem and respiratory failure is rare but a history is important to rule out foreign body aspiration and epiglottitis.

TREATMENT: Prehospital treatment includes a respiratory history and assessment of the ABCs. The typical picture of a gradual onset of cold-like symptoms followed by stridor and a barking cough are hallmarks of croup but epiglottitis and foreign body aspiration must be considered and ruled out by history and comparison of symptoms.

Definitive treatment consists of cool, humidified-air which tends to alleviate the edema and obstruction.

Severe cases may require racemic epinephrine but is recommended that this be a hospital therapy due to potential for arrhythmias and rebound.

EPIGLOTTITIS

Epiglottitis is a bacterial infection (*hemophilus influenzae*) which creates severe edema of the epiglottis, glottic and adjacent tissues. It is an uncommon infection but has lethal potential.

It occurs more often in winter months, the same as croup, but can occur at any time. It commonly affects older children, ages 3- 7, while croup affects younger ages.

Onset is abrupt (hours) with an associated high fever; croup comes on gradually (days) and has low grade or no fever.

Complete obstruction and respiratory arrest are possible if recognition and appropriate treatment is not initiated.

TREATMENT: Prehospital treatment is aimed at minimal intervention once epiglottitis is suspected, unless of course the child is obstructed or severely hypoxic.

If the child is conscious and has a patent airway:

- a. do not touch or handle or agitate
- b. do not attempt to visualize any part of the oral cavity
- c. do not even consider invasive procedures such as an IV
- d. offer 100% oxygen, probably blow-by. If this upsets the child, move it away
- e. DO consider immediate transport, but not in a manner that frightens the child; take parents; notify the hospital of your suspicions so they can be prepared to perform an emergency tracheostomy, if necessary.

If the child is unconscious, apneic or severely hypoxic:

- a. immediately begin bag/valve/mask ventilation with 100 % oxygen
- b. use two-person technique in order to facilitate mask seal and high pressure (override pop-off valve)
- c. initiate immediate transport and notify the hospital
- d. in cases of complete obstruction and long transport, you may consider and REQUEST permission for a needle crico-thyroidotomy if in your scope of practice and protocols

FOREIGN BODY ASPIRATION

Foreign body aspiration is a common problem in young children and infants. As mobility and inquisitiveness increase, so does the incidence of aspiration and obstruction. Statistics again outline the problem: 90% of children who die from foreign body aspiration are less than 5 years of age; 65% in infants.

A history of SUDDEN onset of coughing, choking, stridor or wheezing in a previously well, afebrile child should evoke a high level of suspicion for foreign body aspiration. Croup has a slow onset and does not usually present with choking or wheezing or the same degree of respiratory distress. Epiglottitis presents with sudden onset but the fever, drooling and overall ill appearance of the child is contrary to foreign body aspiration.

Intervention will of course depend on the severity of symptoms.

TREATMENT: Prehospital therapy should be minimal if the child is maintaining his airway. Oxygen may be offered. If tolerated, consider using blow-by. Do not perform blind sweeps of the mouth as this may cause the object to impact and totally occlude the airway.

Neither stridor nor wheezing necessitate attempts to dislodge unless the child's condition deteriorates.

If complete obstruction, loss of consciousness and arrest are present, attempts to remove the object are indicated.

In an infant less than 1 year, use back blows and chest compressions according to BLS standards.

If the child is over 1 year, use the Heimlich Maneuver.

If the object is not expelled and you are trained in intubation, attempt to visualize by laryngoscopy and remove the object using your Magill forceps. Paramedic level units should carry pediatric Magill forceps.

If this is unsuccessful, you may attempt to intubate which should push the object into one or the other main-stem bronchi, thus allowing you to ventilate the other. You should be in contact with your base-station hospital and discussing options with a physician.

Aggressive ventilation and rapid transport should follow. Don't forget to apply a cardiac monitor while enroute.

BLS units who can't expel the object by other means, should REQUEST permission for a needle crico-thyroidotomy. ALS units may also need to consider this therapy in severe situations.

VIEW THE VIDEO PART C

DESIRED OUTCOMES

The completion of Part C should enable you to:

1. List and compare the etiology and typical history of onset for:
 - a. Croup _____
 - b. Epiglottitis _____
 - c. Foreign Body Aspiration _____
2. Describe the signs and symptoms of Croup

3. Describe the signs and symptoms of Epiglottitis

4. Describe the signs and symptoms of Foreign Body Aspiration

5. List the primary prehospital therapy for Croup

6. Outline at least three actions which should not be attempted when epiglottitis is suspected
 - a. _____
 - b. _____
 - c. _____
7. If severe hypoxia or complete obstruction has occurred from epiglottitis, describe what action should be initiated

8. Describe the prehospital care for each of the following:
 - a. partial obstruction due to foreign body aspiration

 - b. total obstruction due to foreign body aspiration

QUIZ

Match the condition (a-c) to the appropriate etiology or symptoms (1-7). A letter may be used more than once.

1. caused by a bacteria _____
 2. acute onset without fever _____
 3. coughing, choking, stridor _____
 4. caused by a virus _____
 5. slow onset with stridor _____
 6. acute onset with fever _____
 7. presence of wheezing _____
- a. foreign body
b. croup
c. epiglottitis
8. Which of the following conditions would have the symptoms of drooling and sniff position?
 - a. foreign body obstruction
 - b. croup
 - c. epiglottitis
 - d. both croup and epiglottitis
 9. Which of the following conditions would have the symptom of stridor without fever?
 - a. croup
 - b. epiglottitis
 - c. both croup and epiglottitis
 - d. foreign body aspiration
 10. Your patient is a 3 year old child who was playing and suddenly experienced coughing, choking and apnea. On arrival you see abdominal heaving but no air is coming from the mouth or nose. The child is extremely blue-gray and in obvious distress. What should you do?
 - a. attempt bag/valve/mask ventilation while obtaining a history
 - b. quickly perform the Heimlich maneuver
 - c. perform alternating back blows and chest compressions
 - d. survey the scene and question the caregiver regarding fever or other illnesses

11. Your patient is a 6 year old who appears to be struggling to breathe. She is cyanotic, lethargic and is lying with her mouth open and tongue extended. Her ventilatory efforts are minimal at a rate of about 40 and her mother states she became ill earlier in the day with what she thought was a strep throat. She has an appointment for the child to be seen at the clinic in the morning. What action should you initiate?
- a. offer the child some water and see if she can swallow
 - b. visualize the posterior pharynx using a sterile tongue blade to look for the white spots characteristic of strep
 - c. do nothing except transport the child to the hospital
 - d. initiate bag/valve/mask assisted ventilation with 100% oxygen and notify the hospital of the situation and your arrival time
12. Your patient is a 2 year old child who has stridor, a barking seal like cough and tachypnea of 46. The mother states the child has been fussy the last couple of days but she also shows you a toy car with a missing wheel. She says that she thinks the child looks sicker than he did about an hour prior. What should you do?
- a. offer oxygen by blow-by and transport immediately
 - b. perform the Heimlich in case the boy has aspirated the wheel
 - c. attempt to visualize the posterior pharynx in case you can see an object and remove it
 - d. attempt to assist ventilation as necessary and obtain a more detailed history

Common Lower Airway Emergencies – Part D

Portions of the lower respiratory tract are termed REACTIVE. These include the bronchi and bronchioles in children and are not fully developed until adolescence. Because of their immaturity, they are prone to constriction when inflamed or as a response to certain other stimuli.

Many diverse problems of the lower airway have the potential to cause respiratory distress symptoms which alarm parents or caregivers and result in EMS being summoned. The goal of EMS is not to diagnose each specific etiology but rather to recognize the presence of symptoms which threaten the child and to intervene with appropriate therapies.

Three lower respiratory tract conditions are demonstrated in the video. They are quite different in etiology but are representative and do have the potential to lead to respiratory failure. Signs and symptoms are stressed in the video; treatments are stressed in the workbook.

ASTHMA

Asthma is an obstructive disease of the lower airways. Asthmatic attacks appear to be the result of hypersensitivity and hyper-reaction to foreign substances.

Some of the foreign substances identified include: viruses, allergens, smoking (passive and active), cold air, exercise. In some children, the exact stimuli are never identified.

The response of the lower airways to the stimuli include:

- a. spasm of the smooth muscle of bronchi and bronchioles resulting in narrowed air passages
- b. edema of the mucous membranes of the lower airways which also narrows the air passages
- c. excessive production and accumulation of tenacious secretions from mucous glands in the lower airways

It can be said that in the child with asthma, the normal reflexes, designed to protect the alveoli, are severely exaggerated and result in harmful reactions.

The child with asthma fights to inspire sufficient air and expends much effort and energy during inspiration. The narrowed airways tend to trap this inspired air rather than allow it to passively exit during expiration. Gas trapping is a major problem because it forces the child to breathe larger and larger volumes of air, thus working harder and harder with each breath.

The constrictive responses also increase airway resistance to airflow and the child is forced to expend energy during the expiratory phase of respiration which is normally passive.

All in all, the expenditure of effort for breathing causes fatigue, decreased respiratory effectiveness and increased oxygen consumption. As the severity of fatigue and obstruction increase, oxygenation decreases, carbon dioxide retention increases leading to hypoxemia, respiratory acidosis and RESPIRATORY FAILURE.

TREATMENT: Prehospital treatment centers around the administration of high concentration, high flow oxygen by face mask.

If possible, encourage drinking of warm oral fluids, even en route to the hospital. Milk should be avoided; clear liquids or water are preferred.

Be aware of the possibility of respiratory failure and initiate ventilatory support per bag/valve/mask to prevent cardiopulmonary arrest.

ALS providers may request permission to administer racemic epinephrine as per protocol. It is recommended that an IV be started and a cardiac monitor applied due to the potential for cardiac dysrhythmias, both from the hypoxemia and epinephrine.

Continuous reassessment for signs of deterioration and respiratory failure are critical.

In severe cases such as decreased LOC, cyanosis, tachycardia or BRADYCARDIA, and obvious labored breathing or irregular/diminished respiratory rate, orotracheal intubation may be indicated. Discussion regarding this therapy should occur with the base station physician.

BRONCHIOLITIS

Bronchiolitis is a viral infection of the lower airways. It occurs in children less than 2 years of age and is often epidemic in late fall and winter months.

The respiratory syncytial virus (RSV) is responsible for over 50% of the cases.

Bronchiolitis begins with simple symptoms such as a runny nose and mild fever. In most children, rest and fluid intake will prevent occurrence of severe symptoms. In other cases, the symptoms will increase in severity and require aggressive intervention.

TREATMENT: Prehospital providers will most often see those children who have respiratory distress including: tachypnea, severe dyspnea, nasal flaring, retractions, wheezing and hypoxemia. Apnea can occur. In some cases, symptoms may be confused with asthma. Be certain to ask about known asthma or prior similar problems.

Administer high concentration, high flow oxygen by face mask and continuously reassess. Ventilatory support may be necessary if signs of distress turn to signs of failure.

Treatment in the hospital may consist of the administration of Ribavirin, an antiviral agent recently approved for RSV infections. It is administered as an aerosol and is usually only used for severe or complicated situations.

It is important to note that infants with preexisting cardiopulmonary disease have an increased incidence of death related to RSV infection. Your history taking skills are of great value in the care of these little patients!

BRONCHOPULMONARY DYSPLASIA (BPD)

BPD is an example of a chronic disorder that develops primarily in premature infants as a result of the therapies used to treat their immature lungs. Prolonged exposure to high oxygen concentrations, endotracheal intubation, ventilator pressures and fluid overload damage the pulmonary tree and make these infants susceptible to respiratory infections.

Alveolar thickening, decreased ciliary activity and areas of atelectasis promote airway obstruction; when these are complicated by infections, respiratory failure can rapidly occur.

BPD infants normally expend considerable energy to breathe and often have continuous supplemental oxygen; in addition, many have delay in normal growth and development due to their prematurity or have significant disabilities such as cerebral palsy, mental retardation, deafness and blindness.

With the increase in home care, EMS needs to be aware of this disorder and understanding as to the fragility of these infants. They have minimum respiratory reserve and can be at risk from even a minor infection.

There is a high mortality rate in the first year of life and parents/caregivers are often extremely anxious. EMS may be required to provide assistance, including stress support for families or cardiopulmonary resuscitation for the infant.

TREATMENT: Prehospital treatment will usually be that required for severe respiratory distress, including oxygen and ventilatory support. The ease with which such infants may deteriorate to failure or arrest demands awareness of the condition, continuous reevaluation and efficient transport.

VIEW THE VIDEO TAPE PART D

Desired Outcomes

The completion of Part D should enable you to:

1. Describe the etiology of asthma:

2. Describe three pathological responses of the airway which occur with asthma:
a. _____
b. _____
c. _____
3. List the typical symptoms which occur with a severe asthma attack:

4. Compare the typical symptoms of asthma to those which occur with respiratory failure:

5. Explain the rationale for prehospital treatment:

6. Define the etiology of Bronchiolitis:

7. Describe the typical signs and symptoms of Bronchiolitis:

8. Compare the signs/symptoms of Bronchiolitis to Asthma:

9. List the basic prehospital treatments for Bronchiolitis:

10. Define the etiology of Bronchopulmonary Dysplasia:

11. Describe the signs/symptoms which usually initiate EMS intervention:

QUIZ

1. Which of the following statements is correct regarding the etiology of Asthma?
 - a. it results from an infection of the bronchioles and alveoli
 - b. it occurs as a result of lower airway hyper-reaction to a stimuli
 - c. it occurs due to hypersensitivity of alveoli from infection
 - d. it is a hereditary condition resulting from multiple allergies
2. Which of the following is NOT a typical pathological problem found in Asthma?
 - a. edema of the mucous membranes lining the air passages
 - b. spasm and constriction of the lower airway passages
 - c. swelling of the subglottic structures and tissues
 - d. excess mucous secretions
3. Which of the following is NOT a typical pattern of symptoms of an Asthmatic attack?
 - a. stridor, grunting and fever
 - b. tachypnea, tachycardia, expiratory wheezing
 - c. intercostal retractions and coughing
 - d. pale color, apprehension and tripod position
4. Which of the following would alert EMS providers that an Asthmatic attack is progressing to respiratory failure?
 - a. auscultation of both inspiratory and expiratory wheezing
 - b. vomiting and cyanosis
 - c. use of accessory muscles to breathe
 - d. diminished breath sounds and wheezing with prolonged expiration
5. A 7-year-old child has been fighting an asthmatic attack for about 2 days. He was seen in the emergency room yesterday and improved after administration of 0.1 mg of epinephrine. On arrival you find him confused, agitated and cyanotic. You can not auscultate any breath sounds: vital signs are; BP 108/ 78, P 158 RR 12. Select the appropriate care.
 - a. give O₂ per mask at 12 liters; start an IV of LR and run at 20 cc/min; obtain a temperature and transport
 - b. initiate ventilatory support per bag/valve/mask and immediately transport
 - c. administer O₂ per mask, attempt to have him drink warm water and have him use his inhaler once more
 - d. begin CPR and contact the hospital

6. You are called to the scene where a 1 year old child is showing signs of tachycardia, tachypnea, wheezing and a dry cough. The mother states the child has had a mild fever and a runny nose for 3 days but became acutely ill this pm. What further information is most important for you to determine at this time?
 - a. what the child's fever is at this time
 - b. if the child has any allergies
 - c. if the child is a known asthmatic
 - d. when the child last ate
7. In addition to the above signs, you also note nasal flaring with both intercostal and supraclavicular retractions. What is the significance of these signs?
 - a. there is diminished airflow and increased work of breathing to overcome the hypoxemia
 - b. they are normal compensatory actions for asthma or infection
 - c. all children with respiratory infections will have these signs
 - d. they reflect the child's ability to fight the problem and are positive indications
8. Which of the following changes in the vital signs of this child should cause you the most concern?
 - a. the coughing triggers vomiting
 - b. the tachypnea changes to bradypnea
 - c. the child becomes lethargic
 - d. the tachycardia changes to bradycardia
9. Which of the following statements is NOT correct regarding BPD?
 - a. it is caused by the therapies used to treat prematurity
 - b. it is a viral syndrome
 - c. BPD infants often have other congenital anomalies
 - d. BPD infants are more fragile and decompensate faster than non BPD infants
10. The most essential skill or knowledge that EMS providers should possess in order to properly care for conditions involving the respiratory tract is?
 - a. ability to auscultate and recognize abnormal breath sounds
 - b. ability to recognize the signs/significance of nasal flaring, positioning, retractions
 - c. ability to recognize progression of symptoms
 - d. knowledge regarding the etiology and therapies for individual airway problems

Respiratory Failure – Part E

The primary focus or goal of this entire module is to instruct you in the PREVENTION of respiratory failure, regardless of the cause.

The video presents an excellent comparison of the signs of distress versus failure, but it is important for you to understand that this state is due to either inadequate oxygenation or inadequate ventilation.

Conditions such as head injuries, continuous seizures and meningitis have the potential to alter normal ventilation resulting in carbon dioxide retention and acidosis. The various infectious conditions already presented impair gas exchange and affect oxygenation. They also end up altering ventilation due to the fatigue of increased work of breathing.

The function of the cardiovascular system is severely altered by the acid/base imbalance of respiratory failure and must be carefully evaluated and reevaluated. When possible, a cardiac monitor should be used to help alert providers of possible problems. It is also recommended that distal pulses, such as the radial or brachial, be routinely compared to proximal pulses, such as the carotid or femoral.

Loss or weakening of distal pulses signals a lack of perfusion and hypotension and represents a grave danger for the child. Loss or weakening of proximal pulses represents the potential for total cardiovascular collapse.

Hypoxemia and acidosis due to respiratory failure are the precursors of full arrest and once complete arrest has occurred, resuscitation is often difficult or unsuccessful or complicated by such problems as severe insult to the neurological system.

Aggressive airway management can often prevent cardiovascular compromise. For this reason, management of the airway takes precedence over transport. This should not be interpreted to mean that time at the scene can be delayed or wasted.

It means that you must initiate treatments that ensure adequate oxygenation and ventilation prior to transport.

VIEW VIDEOTAPE PART E

DESIRED OUTCOMES

After studying the workbook and viewing the videotape, you should be able to:

1. Define the underlying, overall goal of the respiratory module:

2. Compare the symptoms of respiratory distress to those of respiratory failure:

DISTRESS

FAILURE

3. Explain the parameters which influence the decision to transport a child with respiratory impairment against the decision to ensure a stable airway:

QUIZ

1. A 5-year-old child has been found in the garage unconscious. There are no witnesses as to the cause, no signs of trauma but there are many cans and bottles of different thinners and cleaners. However, at this time no clues or signs point to any ingestion. The boy is mottled and cyanotic, has diffuse crackles over all lung fields, has no radial pulse and a faint carotid pulse. Vital signs: BP 60/40 P 168 and irregular RR 66. Which of the following is correct?
- insert airway; apply O2 mask at 12 liters; start IV of LR (if allowed by level or protocol); apply but not inflate MAST and transport
 - initiate transport; while en route apply O2 per non re-breather mask, start IV with LR (if allowed by level or protocol)
 - begin bag/valve/mask assisted ventilation with 100% oxygen at 40/min or intubate according to provider level; initiate transport; establish IV line enroute
 - begin bag/valve/mask assisted ventilation with 100% O2 or intubate; apply and inflate leg compartment of MAST then start peripheral IV of LR; look again for possible etiology of problem and obtain history of other medical problems; contact base station for further help

Match the condition (a or b) to the correct sign (2-7), A letter can be used more than once

- apathy; lethargy _____
- retractions _____
- bradypnea _____
- decreased capillary refill _____
- agitation _____
- tachycardia _____

- respiratory distress
- respiratory failure

8. A 2 year old has been hit by a car. She is unconscious; bleeding profusely from both ears; has obviously fractured lower legs. Vital signs are: BP 50 by palpation P 46 RR 10 and irregular. Which of the following is the number one priority?
- IV of LA
 - transport
 - assisted ventilation
 - cardiac compressions

Prehospital Management - Part F

Regardless of the etiology of respiratory distress, early, appropriate intervention is the key to a positive outcome. Intervention must correct both inadequate oxygenation and/or inadequate ventilation.

LEVEL OF CONSCIOUSNESS should guide prehospital intervention but this determination is sometimes difficult in children. Is the child agitated due to hypoxemia??? or agitated by the fact that the parents are upset??? or due to your presence on the scene???

Is a child apathetic and lethargic because of fatigue or fear??? or is the CNS impaired by acidosis???

Hypoxemia and acidosis directly affect the central nervous system. Minor levels stimulate sensory receptors causing hyperactivity; a child will react with restlessness, agitation and anxiety. Higher levels depress sensory receptors causing unconsciousness or coma.

Hypoxemia and acidosis also affect the heart and cardiovascular system. Minor levels excite the myocardial cells causing 'tachy' rhythms, ectopy (unusual beats) and vasoconstriction. Higher levels depress the electrical system of the heart resulting in bradycardia and systemic vasodilation.

The parents/caretakers will be excellent observers to guide your assessment but there is a general rule that helps avoid dangerous oversights and that is: the quiet child is a sick child until proven otherwise! Err in commission of respiratory support rather than omission.

Remember the following:

- * hypoxemia initially causes agitation/restlessness
- * increasing hypoxemia depresses the CNS causing lethargy
- * an unconscious child should always be suspect for respiratory failure
- * assisted ventilation is as important as application of oxygen

The video provides an excellent review of specific techniques of airway management but there are some points that need emphasis.

1. Prolonged blow-by administration of oxygen can cause hypothermia in infants. Be aware and ensure infants are wrapped and warm in such situations.
2. Suction catheters should have a soft tip to avoid damage to membranes and tissues.
3. A Naso Gastric tube should be inserted when ventilation is assisted either by bag/valve/mask or intubation. Personnel must be specifically trained in this skill; it prevents gastric distention from air which can lead to vomiting or can put pressure on the diaphragm and impair ventilation.

Note: Naso Gastric tube placement is contraindicated in children with head injuries; the tube must be inserted through the mouth rather than the nose to avoid accidental perforation through a fractured skull.

4. If a child does not respond to BVM ventilation with improved responsiveness, color and/or pulse, assume that oxygenation and ventilation are not adequate. Reassess the situation! Be certain the oxygen is flowing correctly! Trouble shoot the entire system!
5. When tubes are placed, especially ET tubes, take the time to tape them securely in place. It is a deadly mistake to have a misplaced tube. Always reassess placement any time a child is moved. Accidental extubation is a COMMON ERROR, especially during movement in or out of a vehicle.

VIEW THE VIDEOTAPE PART F

DESIRED OUTCOMES

The completion of Part F should enable you to:

1. Describe the abnormal affects of hypoxemia on the central nervous system.
 - a. _____
 - b. _____
2. Describe the abnormal affects of hypoxia on the cardiovascular system.
 - a. _____
 - b. _____
3. Identify the appropriate techniques and special points for each of the following prehospital interventions.
 - a. Opening the airway _____
 - b. Suctioning _____
 - c. Oxygen administration
 1. blow by _____
 2. nasal cannula _____
 3. mask _____
 - d. Bag/valve/mask _____
 - e. Pulse Oximeter _____
 - f. Nasogastric tube _____
 - g. Cardiac monitor _____

QUIZ

1. Which of the following correctly describes the effect of major levels of acidosis on the CNS?
 - a. it blocks CNS sensors causing seizures
 - b. it depresses causing unconsciousness
 - c. it excites CNS sensors causing anxiety and agitation
 - d. it has little effect on CNS sensors
2. Which of the following correctly describes the effect of major levels of acidosis on the heart and cardiovascular system?
 - a. it blocks cardiac impulses causing fibrillation
 - b. it excites myocardial cells causing tachycardia and ectopy
 - c. it depresses cardiac cells causing bradycardia and vasodilation
 - d. it has little effect on the heart and cardiovascular system
3. A complication of prolonged blow-by administration of oxygen in infants is:
 - a. iatrogenic hypoxia
 - b. drying of sclera and cornea
 - c. nausea/vomiting
 - d. hypothermia
4. When suctioning children, what does the provider need to ensure regarding the type of catheter?
 - a. that it has a soft tip
 - b. that it is made of pliable plastic
 - c. that it has a dual suction port
 - d. that it is sized to match the small finger of the child
5. When either BVM ventilation or endotracheal intubation is utilized in a child, what other therapy must occur?
 - a. an IV must be started
 - b. application (not inflation) of MAST
 - c. an NG tube should be inserted
 - d. a BP should be ascertained
6. Accidental extubation most commonly occurs in which of the following situations?
 - a. during CPR
 - b. during loading or unloading from ambulances
 - c. when turning a child
 - d. when placing leads for a cardiac monitor

7. An untoward effect of excess pressure on the eyes/eyebrows of a child, especially from the mask during BVM resuscitation is?
 - a. rupture of the posterior chamber of the eye
 - b. elevation in intracranial pressure
 - c. corneal abrasion
 - d. bradycardia

8. Your patient is a toddler who fell into the bathtub. The baby was only in the water about 1-2 minutes before being found by the mother. The child was apneic on your arrival but had a heart rate of 104 and reactive pupils. After about 3-4 minutes of aggressive airway resuscitation you now observe: no change in LOC, pupils are non reactive and the heart rate is 44. What actions should you consider?
 - a. begin CPR and rapid transport
 - b. start an IV line and anticipate needing to defibrillate
 - c. examine your equipment and reevaluate the child's airway
 - d. talk to the mother and carefully attempt to determine if her history is correct/look for any signs of trauma (abuse)

Technology Assisted Children (TAC) – Part G

Health care trends of the 90' s that promote the transfer of long term care from health facility to home have created a population of children who impact EMS in new and challenging ways.

Incredible advances in machines and medications and science have resulted in the survival of premature infants and sick or injured children who only a few years ago would have died--but at a cost--for many of these children survive with disabilities, both physical and mental.

The astronomical costs of hospitalization for these children has had such an economic impact that despite the fact that many require mechanical ventilation to breathe, or a central line for nutrition, or have a colostomy and/or tracheostomy, they are being cared for by family members in their homes!

Educational programs for family members are preparing them in the routine, physical skills necessary to handle these disabilities but when the unusual happens or a crisis occurs, they revert to calling for help as they would for any medical emergency. (911)

The problem--in many instances EMS personnel are not trained to provide assistance. The goal of this portion of the program is to educate EMS regarding the care of a child with a tracheostomy.

A tracheostomy is basically an artificial airway. The surgical opening into the trachea must be maintained by the tracheostomy tube. The opening which is sometimes called a stoma is the entrance into the lungs. If oxygen is needed, it is administered through the stoma. If secretions accumulate in the trachea or lungs, they are suctioned out through the stoma. If ventilatory assistance is required, the mask portion of a BVM is placed over the trach opening to form a seal and the bag is then compressed as usual. If a tracheostomy tube is in place, the valve can be adapted directly onto the tube.

Most emergencies occur when the tracheostomy tube becomes occluded or dislodged. The video presents examples of the different types of tracheostomy tubes and demonstrates how to suction, clean and replace a tube, regardless of the type.

VIEW THE VIDEOTAPE PART G – TAC

DESIRED OUTCOMES

The completion of Part G should enable you to:

1. Identify and describe three different types of tracheostomy tubes:
 - a. _____
 - b. _____
 - c. _____
2. Explain how EMS will recognize when a trach tube has a cuff:

3. Describe the proper technique for suctioning a tracheostomy:

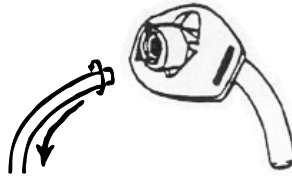
4. List the steps involved in changing a tracheostomy tube:
 - a. _____
 - b. _____
 - c. _____
 - d. _____
5. Describe how to provide assisted ventilation per BVM when there is no tracheostomy tube in the stoma:

6. Describe how to provide assisted ventilation per BVM when a tracheostomy is in place:

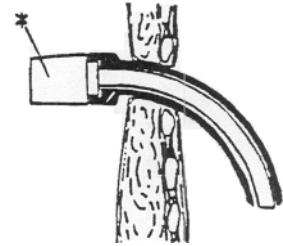
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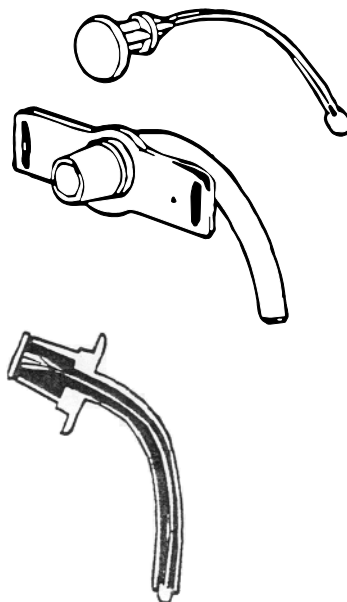


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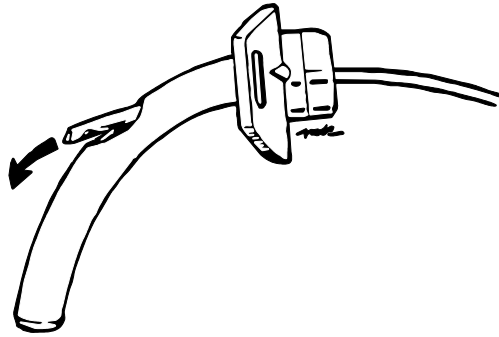


Double Cannula Tracheostomy Tube (*Inner Cannula)

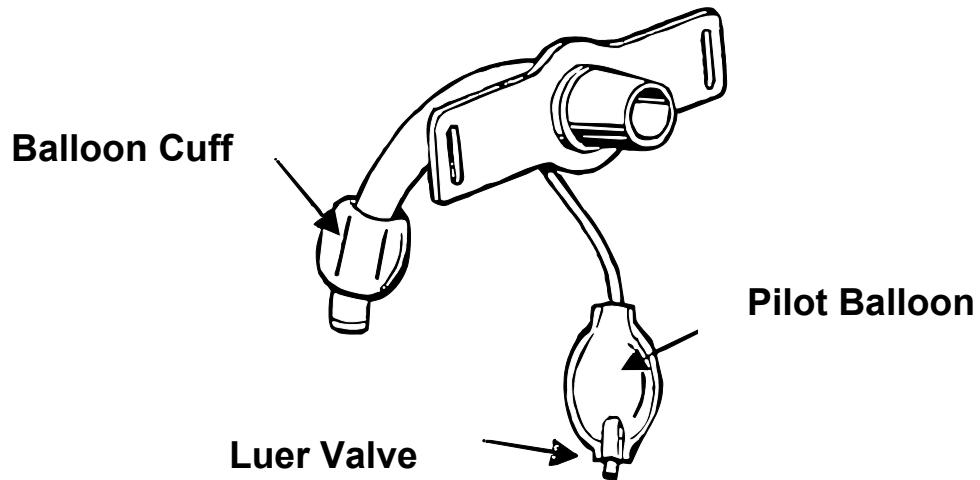
Obturator



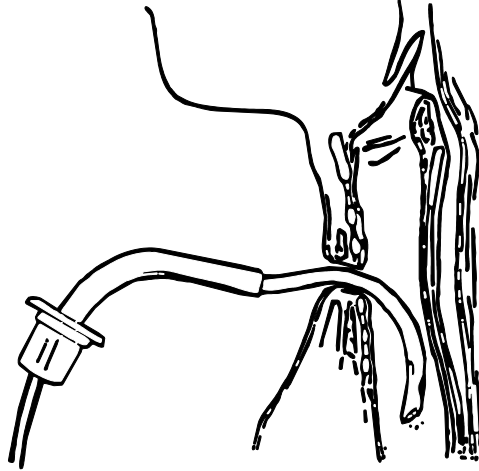
Uncuffed/Single Cannula Tracheostomy Tube with Obturator



Improper Suction Catheter Placement with Fenestrated Tube



Cuffed/Single Cannula Tracheostomy Tube



Tracheostomy Placement Using Suction Catheter as a Guide

SUMMARY

We encourage EMS providers to work with other agencies and identify technology dependent children in their various districts. Make a visit to the home and meet the child and caregivers. Acquaint yourselves with the machines and equipment which is being used; if necessary, ask your Physician Advisor for a special in-service to teach you regarding anything which is unfamiliar.

REMEMBER, the Kids are counting on you. They think you're special and so do we!